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## Yews

## **Creating Comets**

Late next month, if all goes as planned, the "world's first artificial comet" will be created when a satellite stationed, 110,000 km deep in space, just outside the earth's magnetosphere releases a cloud of barium ions. The phenomenon—a bluish-white, 600-km long "cloud" that should be visible to the naked eye for about 10 minutes - will provide scientists with some clues about how the solar wind affects comet tails. The experiment is one of several in a three-nation, three-satellite study of the solar wind, comets, and the mag-

netosphere.

The "artificial comet" experiment will be the second of three sets of scheduled ion releases as part of the Active Magnetospheric Particle Tracer Explorers (AMPTE) project, a study involving scientists from the Federal Republic of Germany, the United Kingdom, and the United States. Two lithium releases have taken place to date. The scientists hope to trace the solar wind's path by using these ion discharges.
Lithium and barium were chosen for two

reasons: The solar wind contains very small concentrations of these substances, and both are easily ionized. Ions, or charged particles, are sensitive to the electromagnetic forces found in space. Ionized barium and lithium atoms released outside the magnetosphere should serve as a "dye" and allow scientists to trace the solar wind's path as it encounters and enters the magnetosphere.

The lithium vapor clouds, which ionize more slowly than barium, will not be visible to the naked eye. However, scientists expect the lithium cloud to expand over an area of 8,000-16,000 km, which will allow them to "map" a large area of the magnetosphere.

Scientists at the Applied Physics Laboratory (APL) of Johns Hopkins University are currently analyzing data gathered from the first two lithium releases. Initial results indicate that lithium was detected inside the magnetosphere by a satellite stationed there but has not yet been conclusively traced to the satellite discharge outside the magnetosphere.

The three satellites used in AMPTE were launched in a stack aboard a Delta rocket from Cape Canaveral on August 16, 1984. The Federal Republic of Germany's 705-kg ion Release Module (IRM), from which the lithium was discharged, is stationed outside the magnetosphere. The lithium and barium are held in 16 ejectable aluminum canisters strapped to the outside of the satellite. Instruments to monitor local conditions around the IRM are also being carried, which will help the scientists select the optimum time for the ion releases.

The U.S. satellite, the 242-kg Charge Composition Explorer (CGE), designed and built by APL, is looking for the presence of the lithium "tracer" ions after they enter the magnetosphere. The United Kingdom Subsatellite (UKS), a maneuverable 77-kg spacecraft, is situated within a few hundred kilometers from the IRM and is designed to measure magnetic fields, plasma waves, electrons, and ions. Several U.S. ground observatories will also monitor the experiments, as will aircraft flying over North and South Pacific ar-

NASA says the AMPTE project may very well have some short-term practical applications in addition to purely scientific discoveries. Data obtained may shed some light on how to protect the delicate electronic circuits carried aboard satellites and manned spacecraft from the solar wind, a stream of hot, ed gas travelling at a speed of about 1.6 × 106 km/h. Spacecraft electronic component failures attributed to the solar wind have been fairly common in the past; exactly how the instruments are damaged is not clear. Results from the AMPTE mission may provide some clues to help engineers "harden" space-craft components against such failures.



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According to NASA, the "comet" created by the December barium release should be isible in the western United States, Hawaii, and parts of the eastern Pacific Ocean. After two more lithium releases, scheduled for March 1985, the "active" phase of the AMPTE project will be concluded. The satellites will remain in space, monitoring the solar wind and the earth's magnetosphere.

## New Solar System

Using sensitive optical instruments and computer enhancement techniques, two astronomers believe that they may have "photographed" what could be a new solar system forming around Beta Pictoris, a star 50 lightyears from earth. Using a 254-cm telescope at the Las Campanas Observatory in Chile, com-bined with a charged-coupled device (CCD) and a coronagraph, an optical instrument developed for detecting very faint objects close to brighter ones, the astronomers photographed clearly for the first time a large group of solid particles, called a circumstellar disk, surrounding the star. This disk may be evidence of a new solar system.

The scientists, Bradford A. Smith of the niversity of Arizona, Tucson, and Richard Terrile of the Jet Propulsion Laboratory (JPL). Pasadena, Calif., say that there is some evidence that planets could have formed around the star. The brightness of the star seen through its disk indicates that the innermost particles of the disk may have been swept away; the formation of planets would produce this effect. However, the astronomers have not yet been able to determine if there are actually planets around the star. The circumstellar disk, believed to be no

more than a few hundred million years old because it is relatively flat, appears nearly edge-on as viewed from the earth and extends more than 64 × 10° km, or more than 400 times the distance from the earth to the

The disk is believed to be made up of particles ranging in size from tiny grains less than ten microns in diameter to the size of the nuclei of comets a few kilometers across. Scientists believe the composition includes ice, silicates and carbonaceous compounds, the same materials from which the earth and other planets of the solar system are believed to

## **GRL Editors:** 1986-1988

The leading rapid publication journal in the geophysical sciences is seeking candi-dates to succeed James C. G. Walker, whose term as editor-in-chief ends December 1985. AGU also seeks candidates to succeed the five regional editors: Rob Van der Voo, North America; Gaston J. Kockarts and William Lowrie, Europe; Tetsuya Saro, Asia; and Kurt Lambeck, Australia.

AGU President Charles L. Drake has appointed a committee to recommend candidates for the 1986-1988 term. Resumes of those interested in serving in these influential and prestigious posts or letters of recommendation from those who wish to suggest candidates should be sent by February 15, 1985, to GRL Editor Search Committee, American Geophysical Union, 2000 Florida Ave., N.W., Wash-ington, DC 20009.

## **PASSCAL Science** Planning

The Program for Array Seismic Studies of the Continental Lithou here (PASSCAL) is one of two major scientific initiatives organized this year under Incorporated Research Institutions for Seismology (IRIS). PASSCAL is a cooperative program open to the whole earth science community, Participation is through PASSCAL committees, which are open to all interested scientists.

The Science Planning and Coordination Committee of PASSCAL will hold an experiment planning meeting at the AGU Fall Meeting in San Francisco. The meeting will be held Tuesday, December 4, 3-5 P.M. in Room 327 of the Convention Center. All interested earth scientists are encouraged to participate in this meeting and to help develop plans for cooperative experiments for studying the continental lithosphere. Experi-ments that can be realized with existing instrumentation, as well as with the PASSCAL, instrumentation, as well as with the PASSCAL instruments currently under development, are encouraged. Topics to be discussed at the meeting include review of science planning and coordination activities of PASSCAL, review of ongoing lithospheric seismology experiments, discussion of proposed experiments, and general discussion of science planning activities.

During the past years, several new cooperative programs to study specific geologic prob-lems have been launched. These activities include both multiyear multidisciplinary studies and single-purpose experiments. Status reports will be presented at the planning meeting on several of these efforts, including the Trans-Alaskan Lithospheric Investigation (TALI), the Appalachian Drill Site characterization study, the Southern Oklahoma Aulacogen wide-angle experiment, and the Long Valley, California, Magma Chamber Study. Presentations from other groups currently conducting lithospheric seismology experiments or individuals interested in proposing new cooperative experiments are also strongencouraged.

These experiments will be important not only for their scientific results but will also serve as prototype experiments for PASSCAL and will provide experience in design and operation of array seismic experiments and developments in data management, processing, and interpretation capabilities. Although a number of lithospheric seismology projects are presently in progress, as described above, it is anticipated that new large-scale array seismic experiments can be successfully com-pleted in the next 2-8 years and will serve as benchmark experiments for the PASSCAL effort. Instruments presently available for lithospheric studies include the 120 compo nent seismic refraction system of the U.S. Geological Survey, portable digital seismo-graphs available from industry on a lease basis, large-spread reflection probling equipment, and a limited number of digital seismographs from universities and national oratories.

Investigators are also encouraged to develop smaller-scale research efforts related to ovements in seismic array studies technology necessary for future implementation in PASSCAL experiments. Such efforts could include studies of effective use of array recording, efficiency of controlled sources, capability for seismograph triggering for natural sources, improved data management procedures, techniques to improve signal-to-noise ratio in array recording, and development of new data processing and interpretation procedures for lithospheric array

We request that persons wishing to present discussions of proposed new seismic experi-ments please contact Bill Ellsworth (U.S. Geological Survey, MS 77, 345 Middlefield Rd., Menlo Park, CA 94025) or Larry Braile, (Department of Geosciences, Purdue University. West Lafayette, IN 47906), and prepare a 5minute presentation of their plans.

This news item was contributed by Bill Ellsworth and Larry Braile, Cochairmen of the Seience Planning and Coordination Committee of PASSCAL.

## Friends of Science

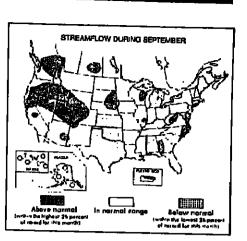
Ten members of Congress have been pre-sented with the Friends of Science Award by the National Coalition for Science and Technology (NCST). The awards, honoring significant contributions to science, engineering, and science education, are made every 2 years at the end of the congressional session The recipients this year are Sen. Pete V. Domenici (R-N.M.), Rep. Joseph D. Early (D-Mass.), Rep. Bill Frenzel (R-Minn.), Rep. Albert Gore, Jr. (D-Tenn.), Rep. Judd Gregg (R-N.H.), Sen. Daniel K. Inouye (D-Hawaii), Rep. Stan Lundine (D-N.Y.), Sen. Sam Nunn (D-Ga.), Rep. Henry Waxman (D-Calif.), and Rep. Ed Zschau (R-Calif).

Except for Sen. Inouye, whose term expires in 1986, all of this year's recipients were up for reelection in the national elections held November 6. All were successful in securing another term in Congress. In addition Albert Gore was successful in his bid for a Senate seat, filling the vacancy left by the re-tiring Senate Majority Leader Howard H. Baker (R-Tenn.)

## September Streamflow

Streamflow decreased seasonally in September but remained in the normal or abovenormal range in about 80% of the country, according to the regular end-of-month check of the nation's surface and groundwater resources by the U.S. Geological Survey (USGS), Department of the Interior. From 174 key index stream-gaging stations, USGS hydrologists reported average flows at 110 sites (63%), well-above average flows (i.e., in the upper 25% of long-term record) at 34 lo-cations (20%), and well-below average flows (in the lowest 25% of record) at 30 stations

By geographic location, streamflows were well above average in most western states, in cluding all key stations in Utah (6) and Colorado (4), and in parts of the central and



southeastern United States. Streamflows were well below average at all key stations in Hawaii (4), Connecticut (4), Maine (3), and New Hampshire (1) and in parts of Florida, Kansas, Minnesota, Montana, Oklahoma, Texas, and the east-central United States.

Record high or near-record high average flows (among the three highest of record) oc-curred in Colorado, Idaho (2 sites), Nevada, Utah (5 sites). Wyoming, and Puerto Rico. Record high streamflow for September occured at two gaging stations which have been in the well-above average range now for 27 straight months: the Humboldt River at Palisade, Nev. (77-year period of record), and the Snake River at Weiser, Idaho (7-1-year peried of record). Record low or near-record low flows occurred in Florida, Hawaii (2 sites), Kentucky (2 sites), Louisiana, and Min-

Reports on the three major U.S. riversthe Mississippi, St. Lawrence, and Columbia—reflected general conditions. Their com-bined average flow was 435 billion gallons per day (bgd) or 5% above average for September. The three major rivers drain more than half of the lower 48 states and provide hydrologists with a convenient check on the overall status of the nation's water resources.

Hydrologist Hai Tang of the USGS National Center in Reston, Va., said that contents of key index reservoirs declined seasonally in September and were average to above average in most of the country. The contents of some reservoirs, however, were much below average: in Montana, New Hampshire, New Mexico, North Carolina, Oklahoma, Texas, and Washington. Tang noted that while most groundwater levels declined during September, most were also above average for the month. In the western states, groundwater levels rose in Washington and fell in North Dakota and Nebraska. Water levels were above average in Washington and in most of ldaho and were below average in Arizona. Texas, and most of New Mexico. Record low levels for September occurred at key USGS observation wells in Arizona, New Mexico, and Texas. Record high levels were reached in Idaho, Nevada, and Utah. All-time high levels were measured at key wells in Califor-nia (27 years of record) and Utah (23 years of

Individual flows of the nation's five largest rivers for September were as follows. While the average flow of each of the "Big Five" rivers declined seasonally from August, flows of four of the large streams were above average for the month. The Mississippi River at Vicksburg, Miss., with an average flow of 176 bgd, was 3% below long-term average; the St. Lawrence River near Massena, N.Y., at 193 bgd, was 15% above average; the Ohio River at Louisville, Ky., 19 bgd, was 27% greater than the long-term average; the Missouri River near Hermann, Mo., at 43 bgd, was 24% above average; and the Columbia River at The Dalles, Orc., at 65 bgd, was 5% greater than the long-term average.

## JGR-Space Physics Editors: 1986-1989

AGU is seeking candidates to succeed Bengt U. Ö. Sonnerup as JGR-Space Physics editor. His term as editor ends December 1985.

The successful candidate, will handle original contributions on aeronomy, magnetospheric physics, planetary atmospheres and magnetospheres, interplanetary and external solar physics, cosmic rays, and heliospheric physics.

AGU President Charles L. Drake has

appointed a committee to recommend candidates for the 1986-1989 term. Resumes of those interested in serving in this critical AGU position or letters of recommendation from those who wish to suggest candidates for it should be sent by February 15, 1985, to JGR-Space Physics Editor Search Committee, American Geo-physical Union, 2000 Florida Ave., N.W., Washington, DC 20009.

News of the Hydrology Section

Editor: Mary P. Anderson, Department of Geology and Geophysics, University of Wisconsin-Madison, Madison, WI 53706 (608-262-2396).

## Information Report

### **AGU Hydrology Section** Committees

The following is a list of officers and com-

#### AGU Hydrology Section: Executive Committee July 1, 1984-June 30, 1986

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85721 (telephone: 602-299-159), Past President: Peter S. Eagleson, Department of Civil Engineering, Building 48-335, Massachusetts Institute of Technology, Cambridge, MA 02139 (telephone: 617-

253-2725). Water Resources Research Editor (Social Sciences): Ronald G. Cummings, Department of Economics, University of New Mexico.

Albuquerque, NM 87131 (telephone: 505-277-3056).

Water Resources Research Editor (Physical Sciences):

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(After December 31, 1984) Soroosh Sorooshian, Department of Hydrology and Water Resources, University of Atizona, Tucson, AZ 85721 (telephone: 602-621-1661).

Eos WaterWatch Editor: (Until December 31, 1984) Mary P. Anderson, Department of Geology and Geophysics, University of Wisconsin, Madison, WI

53706 (telephone: 608-262-2396). Water Resources Monograph Board

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hone: 703-860-6478). ared Cohon, Department of Geography and Environmental Engineering, Johns Hopkins University, Baltimore, MD 21218 (tele-phone: 301-338-7094).

Ignacio Rodriguez-Iturbe, Postgraduate Pro-gram in Hydrology, Simon Bolivar University, Caracas, Venezuela (telephone: 011-58-2-962-1219)

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Vit Klemes, Department of the Environment, Ottawa, Ontario, Canada K1A 0E7 (tele-

phone: 613-997-2605). Keith Hipel, Department of Systems Design. University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.

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### Robert E. Horton Award Committee July 1, 1984-June 30, 1985

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Mark H. Houck (1984), School of Civil Engineering, Purdue University, West Lafay-ette, IN 47907 (telephone: 317-494-2177). Eric Wood (1985), Department of Civil Engineering, Princeton University, Princeton, NJ 08540 (telephone: 609-452-4675). Robert W. Gillham (1986), Department of

Earth Sciences, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1 (telephone: 519-885-1212).

bert M. Hirsch (1986), 410 National Center, U.S. Geological Survey, Reston, VA 22092 (telephone: 703-860-6927).

Robert E. Horton Research Grant Committee July 1, 1984-June 30, 1985

Chairman: Roger E. Smith, USDA-ARS, 301 South Howes, PO Box E, Fort Collins, CO 80522 (telephone: 303-221-0578). Richard L. Cooley, U.S. Geological Survey, Denver Federal Center, Denver, CO 80225

(telephone: 303-236-4995). Ed McBean, Department of Civil Engineering, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1 (telephone: 519-

### **AGU Hydrology Awards:** Horton, Horton, and Horton

There are three individual awards available to hydrologic researchers through the AGU. All three bear the name of Robert E. Horton, and because of this there appears to be considerable confusion among the membership as to the purpose of the awards, eligibility for

them, and the method of their adjudication. The Horton Medal is a Union award. It is given in alternate years to a senior scientist for outstanding research contributions in hydrology made over a period of many years. The selection committee is a subcommittee of the AGU Committee of Fellows. The chairman and the members of the subcommittee are appointed by the President of AGU. The executive committee of the Hydrology Section is usually asked for recommendations for the membership of the Florton Medal subcommittee; in recent years the chairman and all members have come from this section. 1985 is an off year for the Horton Medal, and it will next be awarded at the AGU Spring Meeting in 1986. Nominations are so-licited through notices in Eos that appear well before the deadline date

The Horton Award is a Hydrology Section award. It is given each year to a researcher who has published papers of outstanding excellence in hydrology. It usually goes to a young or middle-aged scientist at the peak of his or her career. The selection committee is appointed by the President of the Hydrology Section. The award is presented at the AGU Fall Meeting each year. Nominations can be sent to the President of the Hydrology Sec-

The Horton Research Grant is also a Hydrology Section award. It is given each year to a Ph.D. candidate in support of a research project in hydrology or water resources. Its objective is to foster graduate student research leading to the completion of doctoral dissertations. It is the only hydrology award that carries a stipend; in 1984 the stipend was \$5500. The selection committee is appointed by the President of the Hydrology Section. The award is presented at the AGU Spring Meeting each year. Applications are solicited through notices in Eos that appear well be-

fore the deadline date. In view of the confusion over three awards having the same name, it would be easy to make a case for changing the name of one or more of them. However, there are good reasons why the Horton name was used in each case. The stipend for the Horton Research Grant and the costs of striking the Horton Medal come from the Horton Fund for Hydrologic Research, a bequest to AGU from the late Robert E. Horton. The Horton Award would perhaps be the easiest to change, yet it is the award with the longest tradition. I would be interested in hearing the views of the membership on this issue.

This information report was written by R. Allan Freeze, President, AGU Hydrology Section.

## News & Announcements

### Contaminant Hydrogeology in the German-Speaking Part of Europe

Introduction

In the (mainly) German-speaking countries of Europe (the Federal Republic of Germany, the German Democratic Republic, Austria, and Switzerland), 70-85% of the drinking water supplies are drawn from groundwater water supplies are grawn from groundwater. Aquifers along many rivers, consisting of glaciofluvial or fluvial granular deposits, are important resources which are recharged by both influent rivers and scepage of winter precipitation. Groundwater is threatened by the continuing and increasing presence of

toxic and mobile contaminants from waste disposal sites, agricultural pesticides and fertilizers, and sewage effluents. Much of the hydrogeological research in these countries is therefore devoted to what has become known in English as contaminant hydrogeology. Unlike the hydrogeologists of the New World, European hydrogeologists do not meet tegularly as a group, and relatively few results from German-speaking researchers are published in English. Consequently, it is more difficult to know what researchers are doing in Europe than it is in North America. Much of the work of German-speaking hydrogeologists was published in "Quality of Groundwater" (the proceedings of the Noordwijkerhout conference, herein referenced as Stud. Environ. Sci., 17, 1981).

### Transport Studies

When considering the problem of defining the nature of transport processes in field studies, German hydrogeologists rely to a considerable extent on field experiments. Although its limitations are recognized, e.g., by Fried (Stud. Environ. Sci., 17, 807-822, 1981). tracer experiments are often interpreted by using an advection-dispersion model. Bel rens and Seiler (Stud. Environ. Sci., 17, 649-657, 1981) noticed an approximately linear increase of longitudinal dispersivity with increasing displacement distance in Bavarian aquifers. Klotz et al. (J. Hydrol., 45, 169-184 1980) concluded from column and model tank experiments that the relation between linear flow velocity and hydrodynamic disper sion deviates slightly from linearity. They assessed the horizontal transverse dispersivity to be much smaller than the longitudinal. Kinzelbach (Water Sci. Technol., in press) determined the hydraulic efficiency of purge well systems for decontaminating aquifers by using a numerical random walk transport model. Buoyancy-induced vertical flows and temperature stratifications near injection wells may result from cooling waters injected into granular aquiters (Melhorn and Kobus, Groundwater in water resources planning, Proc. Int. Symp. Kuhlenz FRG, 593-604, 1983).

To date, the presence of Excherichia (E.) coli bacteria has been used to indicate fecal contamination of groundwater: Alexander and Seiler (Int. Assoc. Hydrogeol. Mem., 14, 73-86, 1982) injected simultaneously high quantities of E, coli and  $^{82}{\rm Br}$  as a pulse stimulus at the Dornach field sire in Bayaria; both maximum response concentrations were found to occur observation wells at about the same time. Matthess and Pekdeger (Stud. Empiron, Sci., 17, 427-437, 1981) added sink terms to the advection-dispersion equation to account for biological elimination of pathogenic bacteria. Isotope methods used in transport studies have been reviewed in a textbook by Moser and Rauert (Isotopenmethoden in der Hydrologie, Gebruder Borntraeger, Stuttgart, Federal Republic of Germany, 1980).

### Chemical Studies

Results of laboratory experiments have been verified in field studies of groundwate contamination using chemicals. Much of the work is related to the study of the retention of trace contaminants in aquifers and is based on the Stumm and Morgan textbook Aquatic Chemistry (2nd ed., Wiley Interscience, New York, 1981). Matthess (Stud. Emviron. Sci., 17, 291-296, 1981) correlated high concentrations of arsenic compounds with negative redox potentials (Eh). The injection of dissolved potassium permanganate as an aquife rehabilitation technique resulted in in-situ As precipitation. Column studies by Dinh et al. (Stud. Environ. Sci., 17, 501-506, 1981) indicated that mercury may be transported without a significant retention from a contaminated influent river to the Rhine aquifer in Alsace under oxidizing conditions. Bank filtration, used along the River Rhine, has proven to retain chemicals such as iron and phosphate (Sontheimer, J. Am. Water Works Assoc., 72, 386-390, 1980

At the Glattfelden site in northern Switzerland, trace metal concentrations show a strong partitioning between water infiltrated from a contaminated river and aquifer sediments and even stronger partitioning in sump sludges of sampling wells near the river bank (Hoehn and von Gunten, Water Sci. Technol., in press). The sorptive behavior of organic microcontaminants (e.g., alkylated and halogenated benzenes) has been studied at this site by Schwarzenbach et al. (Environ. Sci. Technol., 17, 472-479, 1983); the retardation factors of these compounds depend on the respective octanol/water partition coeffcients and the organic carbon content of the fine-grained sediment fraction (Schwarzen bach and Westull, Environ. Sci. Technol., 15, 1860-1867, 1981). Similar results have been obtained from the study of artificial aquifer recharge (Schoettler, DVWK Bull, Boun FRG. 13, 79-94, 1982; Zullei, Stud. Environ, Sci., 17, 601-606, 1981). The theory of multiphase flow in granular aquifers has been ap plied to spills of oil and gasoline (e.g., Fried et al., Ground Water, 17, 586-594; 1879) and halogenated hydrocarbons (Schwille, Stud. Environ. Sci., 17, 451-464, 1981).

search themes, the majority of which will be Groundwater quality management models multidisciplinary, concern aspects of hygiene and health, the engineering of industrial prohave been applied in the German Democratic Republic (Luckner and Nitsche, Stud. Environ. cesses, water resources, and the environmer and agriculture. A specialist training program offering five types of training aimed at uni-Sci., 17, 963-971, 1981; Diersch, Angew. Math. Mech., 63, 479-488, 1983) to problems versity graduates, graduates of engineering of regional groundwater contamination (clated to the use of nitrates (Zwirnmann, Stud. colleges, or experts, will start in October Environ. Sci., 7, 1115-1120, 1981) and to the

International

This international center will also constitute technical support point for the United Cities Water Agency (l'Agence de l'Eau des Cués Unies), which has just been created in Nancy. This agency is a branch of the World Federation of Twinned Cities, designed to form an information link between the member cities.

clides on their transport through heteroge-Commission nous media has been considered in simulation models by Hadermann (e.g., Nucl on Groundwater Technol., 56, 102-105, 1982). European hydrogeologists, as well as those As the U.S. Correspondent to the Interna from other continents, met in Copenhagen tional Commission on Groundwater, Helen J on Sept. 12-14, 1984, for a specialized semi-Peters is beginning to receive information for AGU members in the United States who are nterested in international groundwater mat-

Transactions, American Geophysical Union

The Weekly Newspaper of Geophysics

nar entitled "Degradation, Retention, and Dispersion of Pollutants in Groundwater." Subjects discussed included degradation and retention of organic substances, retention of trace metals and inorganic macroions, and dispersion processes. The proceedings will be published by the International Association on Water Pollution Research and Control, and the meeting will be reviewed in a future edition of WaterWatch.

open cast mining for lignite (Kaden, Rep.

83-92, Int. Inst. for Appl. Systems Analysis,

Laxenburg, Austria, 44 pp., 1983). Solute transport models are linked with multiobjec-

tive methods and techniques of game analysis

tems Analysis, Laxenburg, Austria. The influ-

ence of the chemical speciation of radiomi-,

and have been developed to some extent at

the International Institute for Applied Sys-

Simulation Studies

This information report was contributed by Edward Hoelin, Swiss Federal Institute for Reactor Research, Wuerenlingen.

### International Water Center

The urban district of Nancy and the Town of Nancy, France, have taken the initiative of creating an International Center of Water (Centre International de l'Eau à Nancy-NAN.C.I.E.) in association with two universities, six engineering colleges, the Research Centers of Nancy, the Rhine-Meuse Basin Agency, and the Chamber of Commerce and Industry. The aim of this center is to promote research and technology transfer in the areas of water and sanitation. In 1985 it will initiate a research program drawing on the experience of 350 researchers and engineers of various disciplines who have already been assigned to rescarch in these helds. The re-

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Cover. Epicenters of Australian earth-

quakes with magnitude of (ML) or greater for the period of 1873-1983 are plotted

over the main geological features of the continent. The data set is not complete be-

cause of inadequate instrument coverage, but it should contain all events of magni-

tude 6 and above from 1920 on and all

events of magnitude 5 and above from

1959 on. There may still be earthquakes

of magnitude 4 which occur in the north-

east corner of the continent and are cur-

tently not located. The diagram shows

that the continent is far from being aseis-

mic, particularly in the western region; which experiences a comparatively high

rate of seismic activity for an intraplate re-gion. The reader is invited to correlate the

patterns of seismicity with the main geo-logical features. There appears to be little

or no correlation between the age of the outcropping rock type and distribution of earthquakes, but some of the major faults.

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sediment chemistry, pesticides, toxic metals, and streamflow characteristics. Included are papers on a technique to measure oxygen in the root zone of saturated and unsaturated soils; measurement of surface runoff and collection of sediment samples from small areas; organic carbon in volcanic ash from Mount St. Helens, Washington; organochlorine pes-ticide and polychlorinated biphenyl in the Schuylkill River, Pennsylvania; interference of cadmium carbonate precipitation in the determination of cation exchange separation factors; confidence limits for determining concentrations of tracer particles in sediment

samples; determination of aquatic humic sub-stances in natural water; and use of channel cross-section properties for estimating streamflow characteristics. The new publication is meant to be a forum for topical hyrdrologic subjects. Philip Cohen, Chief Hydrologist of the Geological Survey, said that "dialogue between readers and authors is encouraged, and a discussion section for readers' comments and authors' replies will be included in each issue after the

Copies of "Selected Papers in the Hydrologic Sciences, Volume 1" (U.S. Geological Survey Water-Supply Paper 2262) may be inspected at major libraries nationwide and may be purchased for \$3.00 per copy from the Su-perintendent of Documents, U.S. Government Office, Washington, DC 20402, or from the Distribution Branch, Text Products Section, U.S. Geological Survey, 604 South Pickett Street, Alexandria, VA 22304. Separate papers are not available. Orders must include check or money order payable to the receiving agency (Superintendent of Documents or U.S. Geological Survey) and must specify the report identification number.

### Selected Papers in Hydrologic Sciences

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Callifornia Department of Water Resources,

A collection of short topical papers provid-ing significant results of hydrologic studies by the U.S. Geological Survey, Department of the Interior, has been published as "Selected Papers in the Hydrologic Sciences, Volume (Water-Supply Paper 2262). Edited by Eric L. Meyer, "Selected Papers in the Hydrologic Sciences" is a new journal-type publication that will be a part of the existing U.S. Geological Survey Water-Supply Paper series. The "journal" is aimed at meeting the widespread public and professional interest of the hydrologic community in timely results from hydrologic studies derived from federal research programs, federal-state cooperative programs, and some work done on behalf of other federal agencies

This first volume, comprising eight papers, addresses a broad array of topics covering

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although often originating >100 Ma ago, may still be associated with recent earth-

quakes. As is typical of many intraplate re

gions, all the earthquakes appear to occur within the crust and to be associated with

compressional stresses. To date, over 30

earthquakes have yielded reliable focal

mechanisms which confirm the compres

sive regime. However, the directions of

principal stress are enigmatic and do not appear to form consistent continentwide

patterns. For example, in the southeast part of the continent the maximum com

pressive stress acts approximately north-

west-southeast, whereas in the Southwest

Seismic Zone (~100 km east of Perth) the

stress acts approximately east-west. More data are required to solve the stress regime problem. (Illustration courtesy of David Denham, Division of Geophysics, Bureau of Mineral Resources, Geology

and Geophysics, Canberra, Australia.)

## On the Waterfront

### Meinzer Award and Birdsall Lecturer

Frank Schwartz of the University of Alberta and Leslie Smith of the University of British Columbia have been presented with this year's Meinzer Award by the Geological Society of America (GSA). The Meinzer Award is presented annually by the Hydrogeology Diision of GSA to recognize the author or authors of one of the best papers to appear within the last 5 years.

Charles W. Kreitler of the Texas Bureau of Economic Geology, Austin, has been named the Eighth Birdsall Distinguished Lecturer. The Birdsall Lectures are funded, in part, by an endowment from the late John M. Birdsall. This funding permits the Birdsall Lec-turer to visit a selected number of universities in North America in order to acquaint students with distinguished professionals in the field of hydrogeology. The titles of Kreitler's talks are "Hydrogeology: The Interaction Be-tween Hydrologic and Geologic Processes" and "Hydrologic Characterization of a Sedimentary Basin: The Palo Duro Basin as an

## Meetings

### Nonpoint Pollution Abatement

for any other uses, contact the AGU Publica-A conference on Nonpoint Pollution Abatement: Technical, Managerial, and Insti-tutional Problems and Solutions will be held Views expressed in this publication do not necessarily reflect official positions of the American in Milwaukee, Wisc., on April 23-25, 1985. Sponsors are the U.S. Environmental Protec-Geophysical Union unless expressly stated. tion Agency, Great Lakes National Program Subscription price to members is included in an-nual dues (\$20 per year). Information on insti-tutional subscriptions is available on request. Office, Wisconsin Department of Natural Resources, Marquette University, Water Re-Second-class postage paid at Washington, D. C., and at additional mailing offices. Ess, Transactions, American Geophysical Union (ISSN 0096–3941) is published weekly by sources Center, University of Wisconsin-Madison, Center for Great Lakes Studies at University of Wisconsin-Milwaukee, Metropolitan Milwaukee Sewerage Commission, City of Milwaukee, Southeastern Wisconsin Regional Planning Commission, and the German Marshall Fund of the United States.

This conference will provide an opportunily for an exchange of ideas among scientists, engineers, and policy makers on the prob-lems of and potential solutions for nonpoint pollution. Inquiries should be directed to Vla-dimir Novotny, Department of Civil Engineering, Marquette University, 1515 W. Wisconsin Ave., Milwaukce, WI 53233.

### Engineering Reliability and Risk

A North Atlantic Treaty Organization (NATO) Advanced Study Institute (ASI) on Engineering Reliability and Risk in Water Re-sources will be held in Tucson, Ariz., May 19-June 2, 1985. The purpose of the ASI is to present, within a common mathematical system framework, a tutorial series of fore-front-level lectures and discussions on various aspects of reliability and other incident-related or failure-related criteria in water resources. Such criteria include engineering risk, safety, resilience, vulnerability, and via-

# RESEARCH GRANT **PROPOSALS SOUGHT**

The American Geophysical Union is eeking proposals for the award of the 1985 Horion Research Grant. The deadline is March 1, 1985. The grant will be in support of a research project in hydrology and/or water resources by a PH.D. candidate in an American Institution of higher education. Proposals may be in hydrology (including its physical, chemical or biological aspects) or in the water resources policy sciences (including economics, systems analysis, sociology and law).

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Selection will be made by a committee of AGU's Hydrology Section. The award in the amount of \$7,500 will be made directly to the winner during the 1985 AGU Spring

For a detailed description of the grant and a guide for proposers, write to:

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bility. Lectures will cover hydraulic/hydrologc reliability, reliability related to water supplies and targets, surface and groundwater cases, and decision-making aspects.

The ASI will be held at the University of Arizona in Tucson. The director is Lucien Duckstein, Department of Systems and Industrial Engineering, University of Arizona, Tucson, AZ 85721 (telephone: 602-621-2274 or 602-621-6551; telex: 910-952-1143); the coorganizer is Soroosh Sorooshian, Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ (telephone: 602-621-1661); and the European cofirector is Erich J. Plate, Institute of Hydrology and Water Conservation, Technical University of Karlsrube, Pf 6380, D-7500 Karlsruhe, Federal Republic of Germany (telephone: 49–721–608–3814). The organizing and scientific committee also includes Marcello Benedini (Instituto di Ricerca Sulle Acque, Rome) and Jacques Bernier (Electricité de France, Chatou). A tentative list of lectures and lecturers is available upon request.

Forty-five participants from NATO countries will be selected to attend the ASI. These individuals are expected to be either advanced graduate students, recent Ph.D's, or experienced professionals with a strong motivalion to understand and synthesize the relationship between the various aspects of waterrelated reliability and engineering risk. Individuals who wish to attend the ASI as fulltime active participants are kindly invited to send a letter of intent, a curriculum vitae, and one or two letters of reference from either professors or supervisors in their respective countries. This material is to be sent to the director (or the codirector) as soon as

possible but no later than January 21, 1985. NATO is providing limited travel support to qualified participants. However, potential attendees are strongly advised to seek sup-port in their home country or state for their travel and per diem expenses. Travel support requirements are to be indicated in the letter of intent.

### Subsurface Solute Transport

Substantial advances have been made in the past decade on the development of mathematical models that describe flow and reaction phenomena in subsurface environments. These models arose initially from the separate fields of geohydrology and chemistry; however, as the problem has been further refined and as the science has matured, considerable effort has been devoted to the formal synthesis of these approaches. This has resulted in a class of transport models of increased sophistication, with associated progress in the derivation of governing equa-tions, identification of appropriate mecha-nisms, acquisition of necessary data, and evo-lution of numerical solution techniques.

Accordingly, a symposium is being organized on the inclusion of physical, chemical. and biochemical factors in subsurface transand biochemical factors in subsurface trans-port models. It will be held as part of the AGU 1985 Spring Meeting in Baltimore, Md., on May 27–31, 1985. Papers are solicited in this general area and may include results of theoretical, numerical, and experimental studies. The symposium is being sponsored by the AGU Groundwater Committee. Anyone interested in contributing a paper should submit an abstract in AGU format by February 4, 1985, to Thomas L. Theis, Department of Civil and Environmental Engineering, Clarkson University, Potsdam, NY 18676, or to Linda M. Abriola, De-

Water Watch (cont. on p. 1180)

partment of Civil Engineering, University of Michigan, Ann Arbor, MI 48109. Further information can be obtained by calling Theis at 219-239-6247 or 315-268-7701, or Abriola at 313-763-9664.

### History of Hydrology

The AGU History and Heritage of Hydrology Committee is sponsoring its first sympo-sium, "History of Hydrology: Earth Science Aspects," at the 1984 Fall Meeting in San Franciso. Ten papers, spanning a range of interests, will be presented. The committee plans a second such session, also following a general topics format, for the 1985 Spring Meeting (May 27-31, 1985) in Baltimore, Md. Abstracts for this session should be submitted to the session organizer by mid-February 1985. Persons interested in presenting a paper at this session are encouraged to contact the organizer, Simon Ince, Department of Hydrology and Water Resources, University f Arizona, Tucson, AZ 85721 (telephone: 602-621-3424).

### Regional Water Balance Models

A special session entitled "Analysis of Errors in Regional Water Balance Models" is planned for the AGU Spring Meeting. This symposium is sponsored by the Surface Runoff Committee and will be held in Baltimore, Md., during the week of May 27-31, 1985.

Water balance models have been utilized for decades by agricultural scientists, climatelogists, hydrologists, etc. for a wide range of purposes at various spatial and temporal scales. This symposium addresses regional water balance models applied over regions in excess of, say, 50 km<sup>2</sup> and the much-neglected subject of analysis of errors in these models. Papers are solicited on this topic and may include but are not limited to studies of physical signficance of state variables, parameter identification, effects of alternative networks of climatological variables, effects of different temporal resolution of precipitation data, er-rors associated with different methods of estimating areal evapotranspiration over large regions, accounting for seasonality, effects of spatial variations of parameters, and importance of and mechanisms for dealing with frozen ground and snow melt.

Papers may address traditional applications in hydrology, such as streamflow record reconstruction or groundwater recharge estimation, as well as other applications, such as deelopment of drought indices or National Water Assessment-type activities. All applications, however, should be addressed with an emphasis on error propagation in the water balance models.

Anyone interested in contributing a paper should submit an abstract in AGU format by February I, 1985, to William M. Alley, U.S. Geological Survey, 410 National Center, Reston, VA 22092 (telephone: 703-860-6927).

### Karst Water Resources is Subject of Symposium in Turkey

An International Symposium on Karst Water Resources is scheduled for July 7-19, 1985, in Ankara and Antalya, Turkey. The symposium will be sponsored by the Karst Water Resources Research Center Project of Hacettepe University, the United Nations Development Program, the United Nations Technical Cooperation Department, and the Turkish State Hydraulic Works (DSI). Cooperators will be the Turkish National Committee for the International Hydrological Program, the International Association of Hydrological Sciences, the International Association of Hydrogeologists, and other in-ternational technical societies and United Nations organizations. Activities will take place in Ankara, Antalya, and locations inbetween.

The first week of the symposium will be oc- be received by November 30, 1984.

cupied with technical papers presented orally or by poster format. Papers may be presente in Turkish or English, with simultan translation. Field trips to points of interest around Antalya and between there and Ankars are planned for the second week of the

The technical program is expected to provide broad coverage of topics related to water resources in karst areas. Subjects that may be considered for the symposium include hydro-geology, geochemistry, modeling, laboratory testing, tracer techniques, geophysics and other exploration methods, land subsidence and sinkhole formation, remote sensing techniques, groundwater, and surface water hydraulics and interpretation, engineering properties and problems, water supply esti-mation, and irrigation potential and irriga-

tion practice, among other potential subjects. Notice of intent to offer a paper and/or to attend the symposium should be sent to A. Ivan Johnson, Water Resources Consultant, Woodward-Clyde Consultants, 7600 East Orchard Rd., Harlequin Plaza North, Englewood, CO 80111 or to Gultekin Gunay, Hydrogeological Engineering Department, Hacettepe University, Engineering Faculty, Beytepe, Ankara, Turkey. Details concerning the symposium arrangements and instructions on preparation of abstracts will be sent to those who indicate interest in the sympo-

### Multivariate Analysis of Hydrologic Processes

A meeting on Multivariate Analysis of Hydrologic Processes will be held at Colorado State University, Fort Collins, Colo., on July 15-17, 1985. Sponsors will be the American Society of Civil Engineers, Colorado Section: the Hydrology Section of AGU; the International Association for Hydraulic Research (IAIIR) Section on Methods for Water Resources Management; the IAHR Section on Stochastic Methods in Hydraulics; the International Association of Hydrological Sciences; and the International Water Resources Asso-

Conference proceedings will be published. l'opies for papers include deterministic methods, statistical methods, and joint deterministic and statistical methods.

Abstracts for the meeting are due by Febmary 10, 1984, and a full-length paper must be received by June 1, 1985. Inquiries should be directed to Hydrology and Water Resources Program, Engineering Research Center, Colorado State University, Fort Collins, CO 80523.

### Hydrologic Applications of Space Technology

The International Assocation of Hydrological Sciences (IAHS) and the World Meleorological Organization (WMO) are convening in International Workshop on Hydrologic Applications of Space Technology: Input to Hydrologic Models and Geographic Information Systems, to be held in Cocoa Beach, Florida, August 18-24, 1985. The workshop program will emphasize offered and invited oral or poster papers related to the input of remote sensing and remote data transmission to hydrologic models and geographic information systems.

Organizations interested in exhibiting equipment, systems, or publications or in demonstrating equipment or software programs should contact A. Ivan Johnson, Presilent, IAHS International Committee on Remote Sensing and Data Transmission, 7474 Uphain Court, Arvada, CO 80003. Persons wishing to offer an oral or poster paper for consideration by the program committee should submit a typed, single-spaced original and one copy of a 400-600 word abstract, in English, to Johnson at the above address or to the Secretary General, World Meteorological Organization, Case Postale no. 5, CH-1211 Geneva 20, Switzerland. Abtracts should

AGU STUDENT MEMBER SPECIAL

### Groundwater **Contamination Studies**

The American Society for Testing and Materials (ASTM) seeks papers for the Symposium on Field Methods for Groundwater Commination Studies and Their Standardization, sponsored by ASTM Committees D-19 on Water and D-18 on Soil and Rock. The symposium will be held the week of February 2, 1986, in Cocoa Beach, Florida. The major topic areas include geophysical methods ap-plied to groundwater studies, including borehole geophysics and in situ parameters and surface geophysical methods; sampling methods; field chemical analysis methods and precision; and well construction methods, including well construction and monitoring wells

and casing materials. The purpose of the symposium will be to develop information that can be used to prepare guidelines for groundwater contamina-tion studies and to develop information for methods that can become ASTM standard methods or ASTM standard practices. Presentations for the symposium will be selected by a program committee on the basis of subed abstracts. Offered and invited papers will be scheduled for oral or poster presentation. All papers will be reviewed and considered for publication in an ASTM Special Technical Publication (STP). ASTM may print and distribute accepted abstracts at the symposium with the approval of the chair-

Prospective authors are requested to submit a title, a 300-500-word abstract, and an ASTM paper submittal form by March 1, 1985 to Symposium Chairman Gene Collins, National Institute for Petroleum and Energy Research, PO Box 2128, Bartlesville, OK 74005 (telephone: 918-336-2400). Paper submittal forms are available from Kathy Greene, ASTM Publications Division, 1916 Race St., Philadelphia, PA 19103 (telephone: 215-299-5414). Additional information on the symposium and instructions for submittal of abstracts are available from both Collins and Greene or from Symposium Vice Chairman A. Ivan Johnson, 7474 Uphani Court, Arvada, CO 80003 (telephone: 303-425-5610).

## Meeting Report

### Reduced Liquid Movement Subject of Denver Symposium

Reduction of subsurface movement of liquids was the subject of a 1-day symposium sponsored by Committee D-18 on Soil and Rock of the American Society for Testing and Materials (ASTM) and cosponsored by the U.S. Committee on Large Dams (US-COLD) of the International Commission on Large Dams. The Symposium on Impermeable Barriers for Soil and Rock, the first specialized symposium of its kind, was held in Denver, Colorado, on June 25, 1984. The program emphasized the interaction of the environmental system of soil and rock containment, impermeable barriers, and enclosed liquids. The theory, testing, and design considerations of such interactive systems was explored in relation to slurry walls and clay and earth additive linings as applied to geotechnical engineering projects such as tailings and waste containment ponds, landfills, solar and biomass ponds, ditches, canals, and reservoirs. A number of papers presented research results on the interaction of various chemical and hazardous wastes with the soil and rock materials and lining or slurry

The morning session of the symposium had eight papers addressing slurry walls, while the afternoon session had 10 papers concentrating on clay and soil admix liners. Eight papers were presented as posters during the coffee breaks and lunch period. Symposium papers will be published as an ASTM Special Technical Publication, available later

Ivan Johnson, Woodward-Clyde Consul-

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rants in Denver, and R. K. Frobel, U.S. Bureau of Reclamation in Denver, cochaired the symposium. N. J. Cavalli, ICOS Corporation of America, New York, and C. B. Pettersson. Brown and Root, Inc., Houston, Texas, were the other members of the Symposium Organizing Committee. The symposium was preceded by the Inter-

national Conference on Geomembranes on June 20-24, 1984. This conference was sponsored by the Industrial Fabrics Association International (IFAI) in cooperation with ASTM and 11 other organizations, including the American Society of Civil Engineers, the American Society of Agricultural Engineers, and the Environmental Protection Agency (EPA). Authors at 12 technical sessions discussed the use of geomembranes—rubber, plastic, and other types of flexible synthetic sheeting—as related to such topics as pond liners, floating covers, dams and embankments, pollution control applications, durabil ity, seams and leakage monitoring, water stor age, and more. A trade show with exhibits from 45 manufacturers also was held on June 21 and 22. Two interesting tours visited the Bureau of Reclamation Engineering Center Laboratories in Denver and the Mount Elbert Forebay Reservoir, one of the largest geomembrane impoundments in the world.

The 96 papers presented during the conference were preprinted by IFAI and are available in two volumes for \$49 plus postage and handling charges. To order the symposium proceedings (ASTM STP), contact ASTM, Publications Division, 1916 Race Street, Philadelphia, PA 19103. For the twovolume conference proceedings, contact Industrial Fabrics Association International, 345 Cedar Building, Suite 450, St. Paul, MN

### Land Subsidence **International Symposium** Held in Venice

The Third International Symposium on Land Subsidence was held March 18-25, 1984, in Venice, Italy, Sponsors were the Ground-Water Commission of the International Association of Hydrological Sciences (IAHS), the United Nations Educational, Scientitic, and Gultural Organization (UNES-CO), the Italian National Research Council (CNR), the Italian Regions of Veneto and Emilia-Romagna, the Italian Municipalities of Venice, Ravenna, and Modena, the Venice Province, and the European Research Office. Cosponsors included the International Association of Hydrogeologists (IAH), the luternational Society for Soil Mechanics and Foundation Engineering (ISSMFE), and the Association of Geoscientists for International Development (AGID).

Organized within the framework of UNES-CO's International Hydrological Program. the symposium brought together over 200 in ternational interdisciplinary specialists in the problems of land subsidence due to fluid and mineral withdrawal. Because man's continuing beavy development of groundwater, gas. oil, and minerals is changing the natural regime and thus causing more and more subsiding areus in the world, there had been sufficient new land subsidence occurrence, prob lems, research, and remedial measures since the 1976 Second International Symposium held in Anaheim, California, to develop a most interesting program of nearly 100 papers from about 30 countries. The program consisted of papers covering case histories of fluid and mineral withdrawal, engineering theory and analysis, karst "sink-hole"-type subsidence, subsidence due to dewatering of organic deposits or due to application of water (hydrocompaction), instrumentation, legal, socioeconomic, and environmental effects nd subsidence, and remedial works.

Venice was an appropriate location for the symposium because of the serious subsidence problems there. An interesting 1-day boat trip to local subsidence sites in the Lagoon of Venice was held during the week, in addition to a 2-day field trip on March 24 and 25 in the areas around Venice, the Po River Delta. Ravenna, and Modena.

General cochairmen for the sympowere Lucio Ubertini, Institute Ricerche Idrologica, Perguia, Italy, and A. Ivan Johnson, Consulting Engineer, Arvada, Colorado. Johnson was also Program Chairman, and chairperson for local arrangements was Laura Carbognin, CNR, Venice.

Persons wishing more details about the symposium should contact A. Ivan Johnson. Consulting Engineer, 7474 Upham Court, Aryada, CO 80003 (telephone: 303-425-5610). Papers will be available in a proceed-5610). Papers will be available in a proceedings volume in early fall. The cost of the approximately 700-page volume (IAHS Publication 151) is \$35. The publication may be ordered from II. C. Riggs, IAHS Treasurer, 2000 Florida Avenue, N.W., Washington, DC 20009, Copies of the field trip guide books may be requested from Laura Carbognin, ISD/CNR 1364 San Polo, 80125 Venice, Italy.

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Replies to ads with box numbers should be addressed to Box \_\_\_\_, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, DC 20009.

For more information, call 202-162-6903 or toll free 800-424-2488.

### POSITIONS AVAILABLE

Faculty Position in Applied Geophysica or Structural Geology. The Department of Earth Sciences, University of New Orleans, invites applications for a permanent faculty position commencing August, 1985 in APPLIED GEOPHYSICS or STRUCTURAL GEOLOGY.

The University of New Orleans because on the

The University of New Orleans, located on the south shore of Lake Pontchartrain has 14,00 undergraduate and 2,500 graduate students. The Earth Sciences Department currently has a staff of 11 full-time and four part-time faculty and approximately 150 undergraduate geology majors and 50 master's candidates.

The appointee will be expected to teach graduate and undergraduate courses in groundstice transfer The appointer will be expected to teach graduate and undergraduate courses in geophysics-structural geology and general geology, conduct a program of research and supervise theses. The position will be at the assistant professor level. Applications are encouraged from individuals with industrial experience. The Ph.D. degree is required.

Applicants should send a letter outlining interest in position, complete resume, and three letters of recommendation to:

xiommendation to:
Dr. Louis A. Fernandez, Charman
Department of Earth Sciences
University of New Orleans
New Orleans, LA 70148
UNO, a member of the Lautistana State University
Switch, is an equal conformational formation series System, is an equal opportunity/allumative action

Ph.D. Fellowships/Louisiana State University.
Applications are invited from prosperive Ph.D students in all helds of geology and geophysis to fellowships in the Department of Geology Louisiana State University. The stipends, provided by Arco, Exxon, and the USU Mounti Federation, range from \$10,000 to \$13,500 per year, the awar are made on an around basis and the tennishle to are made on an arroual basis and are renewable for up to three years. One of the benefits of these fel-lowships is a reduction of tuition and fees to about \$100 nor roughly.

lowships is a reduction of ruition and fees to about \$100 per semester.

Applications (plus transcripts, GRF) cores, and three letters of recommendation) must be to erved by March 15. For the Alumni Federation Fellowships, however, the Departmental deadline for receipt of application package is Janoary 7.

Application materials and further information on the graduate program can be obtained from:

Barrun K, Sen Gupta

Director of Graduate Studies

Department of Gerdoor

Department of Geology
Louisiana State University
Baton Rouge, LA 70803-4101.
Louisiana State University is an equal opportunity/affirmative action employer.

Graduate Fellowships/University of Oklahoma.

The School of Geology and Geophysics offers fellowhips for Ph.D. study in each of the following broad disciplines: (1) origin, ascent, and fractionation trends in magmas and ascontated one deposits; (2) formation and tectonic evolution of continental lidisophere, including geophysical properties and structures of the upper crust; and (3) sedimentary processes, including organic and inorganic diagenesis, evolution of hydrocarbone, and correlation using blostratigraphic methods. Average tellowship awards include a waiver of out-of-state tuition and fees.

The School of Geology and Geophysics presently consists of 19 full-time faculty. Research facilities in the school include a stable isotope laboratory; organic geochemistry laboratory; computer automated X-ray diffraction and floorescence equipment; atomic absorption and neutron activation analysis equipment; scanning electron microscope with energy dispersive analyzer; transmission electron microscope; dission-track chaing laboratory; Bud inclusion microthermonetry faboratory; 2 kb hydrothermal laboratory for phase equilibrium experiments; high-pressure rock mechanics laboratory; paleomagnetic laboratory with a cryogenic magnetometer and thermal and AF demagnetization apparatus; 24, 48, and 192-channel digital seismic recording systems; a VAX 11–786 computer with high-resolution graphics and image-display terminals, with seismic and image-display terminals, with seismic and image-display terminals, with seismic tems; a VAX 11-785 computer with high-resolution graphics and image-display terminals, with seismic and image processing software; and a 84,000 volume geology and geophysics library located in the department.

For further information on faculty and active research projects, contact: Kevin Crowley, School of Geology and Geophysics, University of Oklahoma, 850 Van Vicet Oval, Norman, OK 78019.

University of South Carolina. Two year postdoctoral research assistant position anticipated. Person should have a strong background in structural geology of complexly deformed regions along with an interest in geologic mapping and integration of diling date of geologic and geophysical data. Startfor applications December 31, 1986. Closing date for applications December 31, 1984. Applications sent to Prof. Robert D. Hatcher, Jr., Department of Geology, University of South Carolina, Columbia, The University of South Carolina, Columbia,

The University of South Carolinu is an affirmative equal opportunity employer.

Senior Geophysicist. Studies physical aspects of earth, using time domain electromagnetic data. Investigates measured forces affecting earth, utilizing principles of physics, mathematics, and chemistry. Analyzes and interprets data obtained to estimate three dimensional structure of earth's interior and helps locate petroleum and genthermal deposits. Ph.D. in Geophysical Engineering required. 40 hours per week, \$35,000yr. Resumes invited. Qualified applicants contact nearest Job Service Conternation to Job Order No. GO 2523045.

High Altitude Observatory Scientific Visitor Program/NGAR. Scientific visitor appointments at the High Altitude Observatory are available for new and established Ph.D's for up to one year to carry out research in solar physics, solar-terrestrial physics, and related subjects. Applicants should provide a curriculum vitae, including education, work experience, publications, the names of three scientists familiar with their work, and a statement of their research plans. Applications must be received by 15 january 1985 and they should be sent to: The HAO Visitor Committee, High Altitude Observatory, National Center Atmospheric Research, P.O. Box S000, Boulder, Colorado 80307-3000.

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Chairperson/The University of Tulsa, Department of Geosciences. Nominations and applications are invited for the position of Chairperson. Candidates should have a Ph.D. and a distinguished record of teaching and research. Leadership and administrative skills and experience to interact effectively with academics, industry and alumni are required. The department of geosciences has ten faculty members and is located in a new teaching and research complex. There is a strong emphasis on soft rock geology and exploration geophysics in the department which has grown steadily in the last decade. Equipment includes a VAX 11-750 computer with an array processor and seismic data processing software, SEM, Microprobe, NRF, NRP, gas chromatographs and a mass spectrometer. Library reosurces which are supported by "Petroleum Abstracts" are excellent.

stracts" are excellent.

Nonlinations and applications should be sent to:
Colin Barker, Department of Geosciences, University of Tulsa, 600 South College, Tulsa, Oklahoma
74104 by January 15, 1985.
The University of Tulsa is an equal opportunity/
offensation action employee.

The Department of Geology and Geophysics at the University of Minnesons/Senior Faculty in Large Scale Scientific Comparing. The Department of Geology and Geophysics and other science and engineering departments of the Institute of Technology of the University of Minnesota invite applications and nominations to fill a number of senior faculty positions in large scale scientific comparing. Depending on the qualifications of the candidates, these positions will be based in one or more of the science and engineering departments of the Institute of Technology, as part of the academic research and instructional components of the University of Minnesota Supercomputer Institute.

This Institute is a newly formed, developing, University-wide unit, to be operated under the aegls of the Institute of Technology, and is to be the center of academic institutional and research activities in large scale comparing in the University.

A successful candidate must have demonstrated research accompilishments and mellectual leadership in a disriptionary and inter-the oplinary area of briggs scale scientific computing. Facility rank and remuneration are dependent on experience, qualifications, and accomplishments. Applicants whose primary research interests lie in the held of Geology and Geophysics will nominate one or more of Geology and Geophysics will nominate one or more of these applicants and forward these nominations to the Department of the Department of these applicants and forward these nominations to the Department of the properior of the parameters of the paramet

these applicants and forward these monimations to the Dean of the Insulate of Technology for final evaluation. The last date for receipt of applications, including a statement of interest and curriculum si-fac, and names of anytonical professional refer. rate during a statement of interest and curviculum si-rac, and names of appropriate professional refer-ences is January 31, 1985, but departments will be-gur to review applications on November 26, 1984. The University of Minnesona is an equal opportu-nity colutator and employer and specifically nivites and encourages applications from women and mi-norities.

Scripps Institution of Oceanography, Geological Research Division: Stable Isotopea/Sedimentology. Applications are invited for an amicipated opening for an Assistant Research Geochemist. We are looking for candidates with a strong background in themistry, and an interest in paleoceanography, paleocimatology, or carbonate geochemistry and sedimentology. Preference will be given to persons experienced in the operation and maintenance of mass spectrometers. Level of appointment and salary will be commensurate with experience, according to University of California standards. Applications and curriculum vitae (2 copies) and references, should be addressed to Drs W.H. Berger or M. Kastner, Scripps Institution of Oceanography, La Jolla, Ca 92093, A-015.

Marine Geophysicist/Texas A&M University.

The Department of Oceanography invites applicants for a tenure track position in its geological/geophysics and global tectonics. A Ph.D. is required. Rank and salary of the position are open. The successful applicant will be expected to initiate a vigorous research program, have an interest in seagoing activities, and internet with colleagues in the Departments of Oceanography, Geophysics, and the Geodynamics Research Program. Duties will also include the teaching of M.S. and Ph.D. students. The position is available beginning September 1, 1985. Applicants should submit a detailed resume including names of references and statement of research interests to T. K. Treadwell, Faculty Search Committee Chairman, Department of Oceanography, Texas tee Chairman, Department of Occanography, Texas A&M University, College Station, Texas 77845. Closing date for applications is January 31, 1985. Texas A&M University is an equal opportunity/af-

Postdoctoral Positions/Applied Chemistry. Applications are invited for two or more posidoctoral positions in the areas of applied chemical kinetics of Iron(111) reduction. Experience in one or more of the following areas is desired: ligand-substitution kinetics, solution phase kinetics, ester hydrolysis, photo-assisted catalysis, field-oriented cloud-, fog., or rainwater chemistry, homogeneous and heterogeneous catalysis by transition metal complexes, nucleophille substitution reactions, rapid reaction kinetics, or applied microbiology. Send reastine and three letters of reference to Prof. Michael R. Hoffmann, Engineering and Applied Science, W.M. Keck Laboratorics, California Institute of Technology, Passadena, CA 91125.

Physical Occanography, Postdoctoral Fellow.
One to three year appointment for person(s) interested in under-ice coastal circulation and/or boundary layer dynamics. Ph.D. in physical occanography required. Position available approximately I January 1985. Resumes with names of three references should be sent to Dr. R. G. Ingram, Occanography, McGill University, 3620 University St., Montreal, Qué. H8A 282 Canada.
All applicant are encouraged to apply but preference will be given to Canadian officers and permanoni residents.

Astronomy/Magnetospheric/Planetary/Digital Imaging Scientists. This is an opportunity to become involved in state-of-the-art data mattragement issues, techniques, and solutions while simultaneously pursuing research interests. The National Space Science Dala Center at the Goddard Space Flight Center is in an exciting transitional period and has three new openings on its contract staff for data oriented scientists in the above areas. These individuals will join with several others in attacking a broad range of activides, primarily intended to facilitate access to and utility of space science data in an evolving technological environment. These activities include development of an online data cutadog, interfacing with Principal Investigators and spacecraft project offices for data accessibility and documentation, preparing data catalogs, generating techniques for coordinated multispacers delaying techniques. project offices for data accessibility and documentation, preparing data catalogs, generating techniques
for coordinated multi-spacecraft data acquisition
and analysis, and generation of composite or other
value-added data sets. Research interests are encouraged and may be pursued on a substantial parttime basis. A Ph.D is preferred, although a Master's
degree will be considered for some activities. Expetience will space flight experiments, data analysis
techniques, data presentation, publications, and programming is highly desirable. Specific duties will depend upon an individuals background and interests.
Send resume to: Linda Williamson
Sigma Data Services Corp., a M/A-COM Co.
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National Space Science Data Center NASA/GSFC Greenbelt, Mcl. 20771 (301) 344-8148.

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The University of Minnesota: Structual Geology/ Tectonica. The University of Geology and Geo-physics myltes applications for a new, terrore track position in structural geology and tectonics. Cambi-dates will be expected to carry out an active re-search program in their field of interest and to as-sume teaching and advising responsibilities at the undergraduate and graduate levels. A Ph.D. is re-quired. The position will be available fall 1985. Ap-plication deadline is February 15, 1985. Applicants should send curriculum vitae. Ist of publications, statement of research interests, and names of at least three referees to Peter Hudleston, Chartman, Department of Geology and Geophysics, University of Minnesota, Minnesota is an equal opportu-nity educator and employer and specifically invites and encourages applications from women and mi-

Sciamologia/Ohio State University. The Department of Geology and Mineralogy. The Ohio State University, invites applications for a tenure track position for a setsmologist with research interests in crustal geology and rectionics. The successful applicant must be prepared to assist in toaching exploration geophysis contres, advanced topics in hisher speciality, conduct research, and supervise graduate students. Posteloctoral or industrial experience is desirable. Rank and salary commensurate with experience and research record. Please send applications or nonmanous to:

or nonminions to:

Or Ralph R.B. con Frese
Chairman, Search Committee
Department of Geology and Mineralogs
The Chao State University
Colombins, OH 44210
Telephone: 614-422-5135 or 422-7221.
Applications should include a resume, a statement of rewarch interests and the names and addresses of at less three persons whom we may contact for recommendations. The closing date for applications is December 1, 1984; or until position is filled; appointments can be effective as soon as October 1, 1985, Additional information can be obtained by writing or calling the chairman of the search committee.

The Ohio State University is an equal opportuni-

Faculty Position in Hydrographic Sciences. The Oceanography Department, Naval Postgraduate School, has a newly created tenure track position at the assistant or junior associate professor level in the Hydrographic Sciences (MC&G) Program. The applicant should have an earned Ph.D. with an academic background in applied science or engineering and experience in one or more of the following fields: geofesy, photogrammetry and remote sensing, carrography, hydrography, or geodicits surveying. The successful candidate will be expected to teach one or two quarters per year, conduct sponsored research, and provide thesis supervision. A research vessel, excellent computer, and instrumentation are available. Research opportunities are abundant. The Oceanographer of the Navy, DMA, NOAA (NOS), NORDA, and other agencies take a strong interest in the MC&G activities at NPS. There are fine opportunities to interact with physical oceanographers on satellite remote sensing of the ocean. Salaries are autractive. Applicants should submit their resume, including three-to-five references and a listing of research and instructional experience, to Prof. Christopher N. K. Mooers, Chairman, Department of Oceanography, Naval Postgraduate School, Monterey, CA 93943, by 1 January 1985. For additional information telephone Assoc. Prof. Joseph J. von Schwind at (408) 6-16-3271. January 1985. For additional information telepho Assoc. Prof. Joseph J. von Schwind at (408) ti-16-

ployment opportunity/affirmative action employer.

Northern Arizona University/Department Chairperson. Chairperson, associate or full professor.
Department of Geology, Northern Arizona University, beginning summer 1985. Specialty open but
preference will be given to applicants with a strong
lackground in tectonics and tectonic problems. Applicants must be capable of interacting professionally with an active and diverse faculty of 14 geologists
and geophysicists. Candidates should expect to continue an active research program, should have administrative capabilities and a tedication to quality
teaching. The Department has been granted planning authority for a Ph.D. program so it is essential
the successful candidate possess the desire to guide
the Department through the final planning stages.
NAU has a truditional emphasis on field problems
in the Colorado Plateau and adjacent areats; we are
expanding our analytical facilities to improve theoretical and experimental capabilities. Salary will be
competitive and negotiable. Additional duties include teaching and supervising graduate student research. Application deadline: January 15, 1965.
Send curriculum viace, statement of research interests and names of four professional reference in
Search Committee—Code C. Department of Geology, Box 6030, Northern Arizona University is an equal opportunityaffic matien action action of the professional reference in
Northern Arizona University is an equal opportunityaffic matien action action action action.

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Organic Chemical Oceanographer. The College of Marine Studies invites applications for a tenure track position in chemical oceanography. Applicants should have a background in organic chemical oceanography, experience in analysis of specific organic compounds, and held experience. Interest or experience in estuarine and coastal research is preferred. The successful applicant will have the opportunity to develop independent and cooperative research within existing interdisciplinary estuarine and coastal research programs, bacilities available include a modern research compass in Lawes, Belaware, and the 120-box research vessel R.V. Cape Hendspen, Teaching at the graduate level will be expected to develop a funded research program and alvise Ms and PhD students. It is anticipated that the applications from more senior persons are wellonger, Applicants should send currentom chae, perfinent reprints, and the names of direct references to the Charman of the Search Committee: Dr. Jonathan H. Sharp, Oceanography Program, College of Marine Studies, UNIVERSITY OF DELAWARE.

Lewes, DE 1998. Telephone: 302 645-4259 The closing date for applications is permised an equal opportunity alternative action complexes.

Request for Preproposals. The U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, is seeking PREPROPOSALS for oratory, Corvallis, is seeking PREPROPOS AI S for interdisciplinary research on terrestrial processes which contribute to, or untigate, surface water aciditation. The interact of this research is to develop integrated hogeochemical process studies at succepture resentance of areas sensitive to anothermor, with the ultimate objective of characterizing good hermod, building of the processes (and their interactions) which control regional surface water tresponse to acidic deposition. Research may be focused on watershed, plot, or greenhouse laboratory scale projects; integrated process studies are strongly encouraged. ly encouraged.

Written requests for information on proposal submission must be received by December 7, 1984, and should be forwarded to Dr. Raymond G. Wilhour.

Chief, Air Pollution Effects Branch, USEPA, 200

S.W. 35th Street, Corvalits, Oregon 973 Ct.

Postdoctoral Positions In Synchrotron Radiation Research. The State University of New York (SUNY) invites applications for one or more Postdoctoral Research Associates to work on the SUNY beamline at the National Synchrotron Light Source (NSLS), Brocklaven National Laboratory. The beamline has two ports with facilities for crystallographic, diffraction/s attering, small-angle scattering, spectroscopy, and surface science experiments with the synchrotron source. Over thirty SUNY faculty members, in areas as diverse as high resolution crystallography, time-resolved scattering, solid state physics, and structural biology, are participating in the program. A successful candidate will spend partition on a specific research problem in collaboration with a faculty member with common interests. The balance of time is to be spent in maintaining and upgrading beamline facilities. Applicants should have or expect to receive soon a doctorate in experimental work, preferably but not necessarily with x-rays or synchrotron radiation. Experience with computer-automated apparatus, x-ray detectors, x-ray optics, and general instrumentation are all highly desirable. Salary and fringe benefits are competitive for the Long Island region. A complete list of participating faculty and program is available from any of the following members of the Beamline Executive Committee, to whom applications may be sent: Prof. P. Coppens, Dept. of Chemistry, SUNY/Buffalo, Buffalo, NY 14214; Prof. James C. Phillips, MSLS, Brookhaven National Laboratory, Upton, NY 11973; Prof. C. T. Previtt, Dept. of Earth Space and Sciences, SUNY/Sony Brook, Stony Brook, NY 11794; Prof. P. W. Stephens, Dept. of Physics, SUNY/Sony Brook is an affirmatic action/equal opportunity educator and employer. Ak#267-64.

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## UNIVERSITY OF IOWA **DEPARTMENT OF** PHYSICS AND ASTRONOMY

The Department of Physics and Astronomy anticipates openings for two tenure-track assistant professors in August 1985. Preference for one of these positions will be given to an experimentalist. In an exceptional case a term or tenured appointment at the associate professor or professor level will be considered. In addition, one or more openings for visiting faculty members at any level are anticipated. Current research interests in the department are radio and optical astronomy and the following specialities in physics: atomic, condensed matter, elementary particle, laser, nuclear, plasma, and space physics. Faculty duties include undergraduate and graduate teaching, guidance of research students, and personal research. interested persons should submit a résumé and a statement of research interests and arrange for three letters of recommendation to be sent to Search Committee, Department of Physics and Astronomy, The University of lows, lows City, IA 52242.

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Texas Tech University/Geophysicist or Clastic Sedimentologist. The Department of Geosciences at Texas Tech University seeks applications for a tenure track position in the fields of geophysics or clastic sedimentology to begin August 1985. Rank and salary will be commensurate with qualifications. The Ph.D. is required. Entry-level applicants will be given preference. The primary responsibility would be to teach both graduate and undergraduate courses in geophysics or depositional systems and sedimentology, his/her specialty, and introductory geology. The person will be expected to initiate a research program and to direct MS and Ph.D. graduate students. Send a letter of application with complete curriculum vitae and names of three references to Dr. Alonzo D. Jacka, Chairman of Geosciences, P.O. Box 4109, TTU, Lubbock, TX 79409.

Texas Tech is an equal opportunity/affirmative

Texas Tech is an equal opportunity/affirmative action employer. Applications deadline: January 31

University of Wyoming/Department of Geology and Geophysics. The Department of Geology and Geophysics encourages applications from students interested in pursuing graduate research in the fields of igneous and metamorphic petrology and geochemistry. Current research topics, involving field and laboratory studies, include: bland are and continually adequate anything arms. continental volcanics, petrogenesis of granific and anorthositic rocks, evolution of the Archeau crust, petrogenesis of mylonitic rocks, and petrogenesis of mylonilic rocks, and geothermometry and geobarometry as applied to the evolution of orogenic terranes. Facilities include; an analytical geochemical lab for whole-rock and trace element analysis, a fully automated CAMECA microprobe, two JOEL scanning electron microscopes, a thermal ionization mass spectrometer for analysing Rb-Sr. Sm-Nd, and U-Th-Pb isotopes, a microfhermometry lab, and an experimental petrology lab. Applicants should contact:

Petrology/Geochemistry Program

Department of Geology and Geophysics

Department of Geology and Geophysics PO Box 3006, University Station University of Wyoming Larantie, WY 42071.

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Mr. Manuel F. Lujan Ch.

Manpower Placement Unit, AGO

Via Delle Terme di Caracalla

ence.

Assistant Professor—Isotope Geochemistry/The University of Minnesota. The Department of Geology and Geophysics at the University of Minnesota, Minneapolis, invites application for a 3 to 5 year position at the level of Assistant Professor in isotope geochemistry beginning Fall 1985. We are seeking someone with a Ph.D. and preferably some post-doctoral experience, an individual who will be active in research and teaching in addition to the operation of an existing solid-source mass-spectrometry laboratory. The geochemistry program at Minnesota emphasizes its interconnectedness with the in-house programs in igneous and metamorphic petrology, tectonics, hydrogeology and limnology. The holder of this position is expected to continue this tradition in addition to cooperating with or complementing the existing geochemistry, stable isotope geochemistry, and noble gas geochemistry, particularly in the areas of ore genesis, ruck-water interaction, and mantle evolution.

e evolution. Please submit a letter of application and attach a curricultum vita, a statement of research and teaching interests, a list of publications and the names of three to five references. Address your correspondence by February 28, 1983, to Emi Ito, Department of Geology and Geophysics, University of Minnesota, 310 Pillsbury Drive, S.E., Minneapolis, MN 85,158.

20-100. University of Minnesota is an equal opportu-nity educator and employer and specifically invites and encourages applications from women and mi-

Satellite Altimetry: Department of Commorce, National Oceanic and Atmospheric Administration (NOAA). The National Ocean Service, Office of Charting and Geodetic Services annumers a vacancy for the position of Geodesist, GS-1372-13. The position is in the Satellite and Ocean Dynamics Section of the National Geodetic Survey, Rockville, Maryland. This research position will involve analysis of satellite altimeter data for application to ocean dynamics and geodynamics. Applicants should have a detailed knowledge of altimetry, marine geodesy, and physical oceanography, including concepts of geostrophic circulation and planetary wave theory. Investigations will be concerned with sea height variability, equatorially trappeted waves, usstandation of altimeter data into numerical models, and other topics of importance to established national programs in ocean and climate studies. The position requires a demonstrated ability to do scientific research as evidenced by publications in the literature. A Ph.D. in physical sciences or equivalent is desirable. Persons innerested in applying may request a copy of the vacancy announcement which contains qualification requirements, by writing to Ms. Louise Turner, RAS/DE25, NOAA, National Ocean Service, Rockville, Maryland 20852, or by calling 301-443-8995. Applications should be submitted on Standard Form 171. Closing date for applications is 12-10-84.

Department of Commerce is an equal opportunity employer. U.S. citizenship required.

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knowledge of Arabic desirable.

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Computer Manager/Minicomputer Specialist.

Memphis State University seeks a candidate to manage a PDP 11/44 and a major facility expansion to include a superminicomputer system (VAX 11/785 class) to be dedicated to research applications in the Geological Sciences and Geophysics. Hardware and software are designed for digital seismic data acquisition, digital seismic data processing, and graphical representation of geological and geophysical data.

acquisition, digital selimic that processing, and acquisition of geological and geophysical data.

The candidate must have at least a BS degree in Computer Science, Electrical Engineering or related field; three years programming experience including FORTRAN and ASSEMBLY; knowledge of various computer hardware and two or more widely used operating systems; ability to per for in numerical data analysis. Knowledge of PASCAL and C languages and RSX IIM operation system will help. Salary is negotiable depending on experience. Applicants should submit a resume, copies of academic transcripts, and the names, addresses and telephone numbers of three references to:

Dr. [cr-Ming Chiu
Memphis State University
Tennessee Earthquake Information Center
Memphis, TN 58152.

Applications must be received by December 10, 1984.

984.
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(firmative action employer.

Geochemistry. The University of California, Davis will fill a permanent, tenure track, faculty position at the assistant professor level beginning Fall, 1985, Candidates having interests in isotope geochemistry and/or the geochemistry of economic deposits are especially encouraged to apply but other specialties in geochemistry will be considered. A I'nD degree is required. Responsibilities include teaching at the undergraduate and graduate levels, and research in geochemistry.

Applicants should submit complete vita, a statement of research and teaching interests and the names of three referees. Deadline for application is january 15, 1985. Inquiries and applications should be directed to: Dr Howard W. Day, Department of Geology, University of California, Davis, CA 95616.

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Professor of Hydrology/Utah State University.
Professor of Civil and Environmental Engineering
or Agricultural and Irrigation Engineering with research at the Utah Water Research Laboratory. Posearch at the Utah Water Research Laboratory. Position in surface and ground water hydrology requiring proven research and teaching leadership, as a full Professor with internationally recognized academic credentials, related to hydrologic studies for water supply, flond control and salt management at a basinwide scale. Opportunity to lead or work with an established team of researchers on group projects. Nine months appointment base. Send resume, names of at least three references and statement of research and other career goals by lanuary ment of research and other career goals by January 1 1985 to: Douglas James, Director, Utah Water Re-search Laboratory, UTAH STATE UNIVERSITY, UMC 82, Logan, Utah 84322. An Affirmative Action/Equal Opportunity Em-

Seismologiat/University of Illinois. Applications are solicited for a tenure-track position at the Assistant Professor level in seismology. A creative individual is sought who will develop a research program that complements our existing programs in seismologic consequences of the professor in the programs in seismologic consequences. that complements our existing programs in seismology (currently emphasizing source properties), geodynamics, tectonics, and rock/unineral physics. An excellent research environment and outstanding facilities are available both in the Department and the University. A Center for Super Computer Research and Development is presently being formed at the University. In addition, our campus is the site of a proposed regional computational facility. Opportunity exists to interact with the department of Theoretical and Applied Mechanics. The position is expected to be filled as early as Fall. 1985. Salary is commensurate with experience; a PhD is required. The successful candidate is expected to participate in teaching and advising at the graduate and undergraduate levels. For equal consideration, interested individuals should send curriculum vitae, list of publications, statements of research interests and names of three or more references by December 15, 1984 to:

Professor Albert T. Haui Frotesor Acter 1. Faul
Department of Geology
University of Illinois at Urbana-Champaign
1301 W. Green Street
Urbana, Illinois 01801.
Tel: 217/333-7732 or 333-3542.
The University of Illinois is an equal opportunity/affirmative action employer.

Opportunities for Graduate Studies in Atmospheric Sciences at the Georgia Institute of Technology. Openings are available for outstanding individuals seeking an M.S. or Ph.D. degree in graduate studies in atmospheric sciences. For auccessful applicants, these positions include 44-time research assistantships with starting salaries ranging from \$8,000 to \$12,500/12 months, depending on the degree being sought and the student's qualifications. All tuition and fees are also covered by the Institute. Complete applications with supporting documentsshould be received no later than March 15,

Interested students should write to: Dr. Douglas D. Davis School of Geophysical Sciences Georgis Institute of Technology Alkanta, GA 30332.

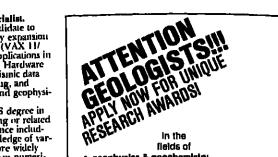
The Johns Hopkins University/Paleontologist.
The Department of Earth and Planetary Sciences invites applications for a tenure-track faculty position, effective July 1, 1985, for a paleontologist tion, effective July 1, 1985, for a paleontologist whose research will strengthen the link between our paleontology and sedimentology programs. The appointee will be expected to develop an innovative research program, and responsibilities will include undergraduate and graduate teaching and the supervision of doctoral candidates.

To apply, send curriculum vitae, publications list, and the names of at least three referees to Dr. John M. Ferry, Department of Earth and Planetary Sciences, The Johns Hopkins University, Bahimore, MD 21218, U.S.A. The application deadline is January 15, 1986.

2 Joins Hopkins University is an equal opportunity, affirmative action employer.

University of Illinois at Chicago. The Department of Geological Sciences seeks to fill tenure track positions probably, but not necessarily, at the rank of assistant professor, probably effective Fall, 1985, pending budgetary approval, in one or both of the following disciplines: 1) Geophysics (preferably in seismology); 2) sedimentary geochemistry. Each person is expected to teach both undergraduate and graduate courses and to conduct a vigorous research program, including the supervision of graduate sudents. PhD required. Applicants should submit a detailed resume, namea and addresses of three references, and an explanatory statement of research and teaching interests by February 28, 1985, to Robert DeMar, Department of Geological Sciences, University of Illinois at Chicago, Chicago, Illinois 50880. Representation of the Department will be at the AGU Fall Meeting in December.

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geophysics & geochemistry
 earthquakes & volcanology
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The National Research Council in cooperation with selected Federal laboratories will offer approximately 250 awards in 1985 for independent scientific research. Recipients will be free to work on problems of their own choice as guest investigators at the participating Federal laboratories. Many of the 22 programs are open to experienced senior scientists as well as to recent PhD's. Stipends begin at \$26,350 for recent graduates and are appropriately higher for seniors. Recipients in travel on tenure are available, and a health insurance program is offered.

For further information and application meterials please write to: Associateship Programs (JH608/U-3)

National Research Gouncil

2101 Constitution Avenue, N.W. Washington, D.C. 20418

Deadlines for application are January 15. April 15 and August 15.

Seismologist/University of Utah. The Department of Geology and Geophysics at the University of Utah seeks applicants for a tenure track faculty position in seismology at the assistant to associate professor level. Applicants with backgrounds and specialties in seismic imaging, seismic reflection or theoretical seismology will be given preference. The individual will be expected to teach undergraduate and graduate courses and to pursue an active reindividual will be expected to teach fundergraduate and graduate courses and to pursue an active research program with graduate students. A veismic imaging laboratory with a VAX 11/730, FPS array processor, plotters, and processing and synthetic seismogram software is available to the successful candidate. Current research in seismology includes: earthquake research utilizing a PDP 11–70 computer; monitoring of the Intermountain seismic belt by an 85 station telemetered network utilizing an online PDP 11–34 computer; major experiments in seismic refraction and reflection probling for crustal structure; and allied research in tectomophysics. The seismic retraction and retlection probling for crustal structure; and allied research in tectomophysics. The opportunity exists to participate with several other faculty in an integrated program of tectonics, seismology and sedimentology directed toward crustal studies and petroleum exploration. The geophysics component of the department has active research and teaching programs in electrical and electromagnetic methods, thermal properties of the earth, potential fields, and seismology. The department has close associations with the numerical analysis and data processing groups in computer science, electrical engineering and mathematics. The closing date for applications is December 31, 1984, and the appointment date is September 15, 1985, A Ph.D. is required for this position. Applicants should submit a via, transcripts, a letter describing his/her research and teaching goals and names of five persons for reference. Qualified persons should send their applications to William P. Nash, Chairman, Departmet of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84 I 2—1183.

The University of Utah is an equal opportunity/affirmative action employer. structure; and allied research in tectonophysics. The

Seimologist/Northern Hinois University, Department of Geology. The Department of Geology seeks to fill a tenure track position in Geophysics at the rank of Assistant Professor beginning August 15, 1985. Candidates with postductoral experience in applied seismology and whose research will involve students in field programs are most desired. The successful candidate will be expected to participate in and enhance an autressive research propate in and enhance an aggressive research pro-gram, teach at both the graduate and undergradu-ate levels, and interact with faculty and students in ate levels, and Interact with faculty and students in geophysics, geology, geochemistry and hydrology. The Department, which offers both the M.S. and Ph.D. degrees, is composed of 15 faculty active in a wide range of research programs. Pertinent equipment owned by the Department includes a minicomputer, several magnetometers and gravimeters, a seismometer and a marine seismic system. Applicants should send a letter of application, resume, statement of research interests, and the names of three references to: Chair, Geophysics Search Committee, Department of Geology, Northern Illinois University, DeKalb, IL 60115.

Application deadline is January 15, 1985. Northern Illinois University is an equal opportunity/affirmative action employer.

Sedimentary Geochemist/Geologist. The Department of Geological Sciences at Lehigh University announces the availability of a tenure track position at the Assistant Professor level starting September 1. announces the availability of a tentire track pointer at the Assistant Professor level starting September 1, 1985. The successful candidate will be expected to teach both graduate and undergraduate courses and to maintain an active research program. Primary consideration will be given to those whose research experience and professional interests are in low-temperature sedimentary geochemistry, but outstanding candidates in related research areas will also be considered. The Department of Geological Sciences has nine faculty members and some 36 graduate students. Research facilities include automated XRF and XRD within the department; electron microprobe; analytical SEM, TEM, AA, etc. are available on campus. Respond with a letter describing research interests, full curriculum vita, and the names of three references by December 15, 1984 to: Charles B. Scier, Chairman, Department of Geological Sciences, Lehigh University, #81 Williams Hall, Bethlehem, Pennsylvania 18015. Applications received after December 15 may not be given full consideration. sideration.

Lehigh University is an equal opportunity/affirmative action employer. Women and minorities are especially encouraged to apply.

Caltech University. The Division of Geological & Planetary Sciences at the California Institute of Technology expects to offer postdoctoral research fellowships in one or more of the following areas: geology, geophysics, geochemistry, and planetary science. Interested persons are asked to send their resumes to Dr. Peter Wylle, Chairman, Division of Geological & Planetary Sciences, California Institute of Technology, Pasadena, Calif., 91125.

An Equal-Opportunity/Affirmative-Action Employer:

Middlebury College/Metamorphic Petrologist.
The Department of Geology seeks a metamorphic penologist with an interest in tectonics. The regular itemure-track) entry-level position requires the PhD and begins in the fall of 1985.

and begins in the 15H of 1985.

The 4-member department maintains active research and an on-going field and lab program with students in rectonics, pertology, and occarrography. Teaching responsibilities normally include 3 semester-courses, a 1-month winter term course, and supervision of senior research. The department has an XRD/XRF laboratory and an automated electron microprobe. microprobe.

Send application, including resume, research in-

Send application, including resume, research in-terests, transcripts, and 3 current letters of refer-ence to: Brewster Baldwin, Chairman, Department of Geology, Middlebury College, Middlebury VT 05753. Application deadline is February 1, 1985, Middlebury College is an equal-opportunity em-ployer.

University of Wisconsin—Madison. The Department of Ceology and Geophysics invites applications for an anticipated tenure track position at the assistant professor level in applied geomon pludogy and/or hydrogeology commencing in August 1985. The applicant should be committed to developing a strong research program as well as teaching undergraduate courses in some aspects of engineering and environmental geology. The Ph.D. is required. Applicants with course work in engineering and an interest in the field application of geologic principles are especially encouraged to apply. Send letter of application outlining your professional goals, transcripts, resume, copies of publications, and three letters of reference to Dr. Mary P. Anderson, Department of Geology and Geophysics, Weeks Hall, University of Wisconsin, Madison, WI 53706. Closing date is January 1, 1985.

The University of Wisconsin is an equal opportunity/affirmative action employer.

Faculty Position in Structural Geology/Tectonics.

The Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, has a tenure track opening at the Assistant or Associate Professor level in the area of structural geology/tectonics. The position will be filled for the beginning of the Fall 1985 term. The department currently has 31 full-time faculty, including 12 geologists and geophysicisis.

The successful applicant will be expected to have completed the PhD degree. Courses to be taught include undergraduate structural geology as well as courses in structural analysis, tectonics, or other areas of research activity. He or she additionally will be expected to develop a vigorous program of sponsored research and to direct graduate student research projects at the MS and PhD level.

Please send complete resume and the names of at least three references to V.V. Cavaroc, Search Committee Chairman, Department of MEAS, North Carolina State University, Raleigh, NC 27695–8208;

phone (919) 737-2212. Applications will be considered as received, with a closing date of January 15, os. North Carolina State University is an equal op-

portunity/affirmative action employer.

University of Utah Structual Geology/Tectordes/
Tectooophysics. The Department of Geology and Geophysics at the University of Utah seeks applications for a tenure track position in structural geology, tectonics or tectonophysics. It is anticipated that this position will be filled at the assistant professor level, but applications by more senior persons will be considered. The position requires a Ph.D. with emphasis in structural geology, regional tectonics or tectonophysics. The new faculty member will lave the opportunity to teach in the area of his or her specially and may also be assigned introductory level courses. The successful candidate will be expected to establish a vigorous research program involving graduate students. The person who fills this position will join an active program in structural geology and tectonics that includes both field projects and integrated geology/geophysics ans meclanics/fluid chemistry studies of structures in the western Cordillera. There is an excellent opportunity to collaborate with other faculty in structural geology, sedimentology, geophysics, geochemistry and petrology. A vita, copies of publications, names of three persons that may provide references, and a letter outlining the candidate's research and teaching interests should be sent to Dr. William P. Nash. Chairman, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84:112–1183.

Dealline for receipt of applications is December 31, 1984 with the appointment starting in September 11, 2000.

The University of Utah is an equal opportunity/ firmative action employer.

POSITIONS WANTED

Physical Oceanographer. M.S. 1983. Experience in hydrographic data acquisition and analysis in the SW Atlantic and NE Pacific. Seeking a position as research assistant in academic institution, industry or government. RMO, 2855 Three Mile Lane, McMinnville, OR 97128.

STUDENT OPPORTUNITIES

Graduate Teaching and Research Assistantship in Marine Environmental Sciences and Coastal Oceanography. Opportunities for graduate study with graduate and research assistantships available for students interested in MS and PhD degree programs in marine environmental sciences and coastal oceanography. Awards cover tuition and academic year stipend up to \$7,883, Additional summer support also available up to \$3,000. Write: Graduate Programs Chairman, Marine Sciences Research Center, SUNY Stuny Brook, Stony Brook, NY 11794.

Meetings

## Announcements

### Envirosat '85

September 10-13, 1985 Envirosat '85, Washington, D.C. Organizer: NOAA. (Program Committee, 2nd Envirosat Conference, NOAA/NESDIS, E/ER2, FB#4, Mail Stop D, Washington, DC 20233.)
The deadline for the submission of ab-

stracts is December 15, 1984.

This is one of a series of interrelated activities that NOAA will present in 1985 to celebrate the 25th anniversary of the U.S. environmental satellite program. The conference will provide an opportunity for researchers from both the public and the private sectors to exchange ideas concerning future environmental remote sensing programs, availability and sources for products and services, and trends in satellite environmental services. The primary objective is to increase user awareness of current and future applications of remotely sensed environmental data. Papers are needed in the areas of hardware and software, including current and future space platforms, communications, and display equipment; sensor applications, including oceanography, weather and climate, and land mapping and monitoring; public and private sector interests, including new and unique applications and improved data services; and uture trends, including microprocessor applications, research and development directions, and new developments.

> Does your library have a standing order to the **Geodynamics Series?**

### Arid Lands

October 21–25, 1985 International Conference on Arid Lands: Today and Tomorrow, Tucson, Ariz. Sponsors: UNESCO. University of Arizona. (G. P. Nabhan, Office of Arid Land Studies, Univ. of Arizona, Tucson, AZ 85721.)

The deadline for the submission of abstracts is December 15, 1984.

The sponsors plan a full and varied program, including a trade fair of arid lands technologies, films from around the world, and presentations of both solicited and invited papers. Themes for papers include water use, conservation, and allocation; agricultural systems and the adaptations of their plant and animal resources; natural resources reclamation, conservation, and use; and human habitat, including architectural, urban plan-ning, and cultural adaptations. In addition, short courses on related subjects will be offered before the conference, and field trips and special meetings are planned for after-

### ATTENTION SUBSCRIBERSI

Beginning in 1985 Reviews of Geophysics and Space Physics

will be titled Reviews of Geophysics. Approximately 600 pages to be published in Volume 23, 1985

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### Aeronomy

0430 Procesure, Density and Thapperstorn SOLAR INSUCED CICILLATIONN IN THE STRATOHISKER: A NTR OR REALITY

All), h. R. Clamesha, h. M. Simonich and V.W.J. H. Kirchhoff.

The vertical distribution of atmosphoric sodium has been beauted at São José dos Campos (2705, 46%) over a total of about 20 complete diurnal cycles between holium density show atrong oscillations with 12 and 24 hour periads. Both the diurnal and semidiurnal components of the nacillation display large amplitudes and also phase inversion near the layer peak. These ideas in interpreted in terms of the propagation of lates in the layer, taking into account the interaction is shown that the wortical wind is the most important tion in sodium density at a fixed height, thus saling the peak of the continue the saling of the world display large. It factor which determines the amplitude of the owild a solium density at a fixed height, thus saling wind oscillations over a timited height range. Blurnal and 570cm 1, respectively, have been interpret. The savelangth of 50 km, in agreement with recent characteristics of an evanescent mode instead of the caputed site of an evanescent mode instead of the caputed in the savelangth of 50 km, in agreement with recent characteristics of an evanescent mode instead of the caputed site of an evanescent mode instead of the caputed site of an evanescent mode instead of the caputed that component. These capits a paper to be the displacement in the assopsines of tidely indeed vertical tides, management in the assopsines ranger.

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## **Exploration Geophysics**

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RCALE-MODEL RESPONSE OF A THE VERTICAL CONDUCTOR RELOW A
CONDUCTIVE, INDUCTIVE, OR LATERALLY INHOHOGENEOUS
OVERBURBEN LATER
V.S. John 'Theoretical Geophysica Group, National
temphysical Research Institute, Hyderabad 500 007, Indial
O.F. Gupta, and J.G. Nagi
The electromagnetic conductors of laterest are often
overlain by a partially conducting overburden layer which
may be uniform or varying lo conduct ance
iconductivity-thickness product) and which may or may not
be in Raivanic contact with the target conductor below.
Laboratory scale-model experiments for the Stingram
configuration are conducted to simulate such realistic
conditions. Pesulis generally indicate the following, til
The overburden with uniform conductance and inductive
coupling with the masalve sulfide vein-type oreholy
attonuates the response of the target and causes a
clockwise rotation of the showaly index diagram (AID)
related to its conductance. The better the conductar, the
more serious would be the error in estimating its
conductance. The depth index curvos in the AID shift
toward greater depth-vo-the-top of the conductar. (2) A
conductively coupled everburden distinctly improves the
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RAY EQUATIONS IN EXTREMED SECIL MIDPOINT COORDINATES
Alfons Gooseler-Serrano Promarly Department of
Geophysics, Stanford University; presently Geneource,
Inc., 6909 Southwest Fracusy, Bonston, TZ 772361 Hathaw
1, Yadlin-

inc., 5909 Southwest Freeway, Houston, TZ 77236) Mathew J. Yadlin.

Group velocity (ray) equations demoribe the dynemic behavior of vava-equation estrapolators in the sigh-frequency lists. They are found in general from the disparsion relation of an arbitrary access in wave equation. Wear-equation operators require a background extrapolation velocity. As an application of the group velocity clustrates the tenda-off between upcortainty in velocity equations a sensitivity analysis of the mackground-operator velocity (instrates the tenda-off between upcortainty in velocity and precision in imaging. East wave extrapolators are most useful when the mass velocity franction is known. Wava-equation imaging. East wave entrapolators are most useful when the mass velocity franction is known. Wava-equation imaging for velocity enemative astrapolation coordinates requires expressional properties are referenced to an arbitrary small of groups velocity equations show that its limit groups in the interest of the interest o

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(Paper 480/12)

David D. Polkard and Attila Aydin

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